Annual Summary
Hawaii Air Quality Data

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STATE OF HAWAII
DEPARTMENT OF HEALTH
CLEAN AIR BRANCH

2005
HAWAII AIR QUALITY DATA

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Section 1
INTRODUCTION

The Department of Health, Clean Air Branch, monitors the ambient air in the State of Hawaii for various gaseous and particulate air pollutants. The U. S. Environmental Protection Agency (EPA) has set national ambient air quality standards (NAAQS) for six criteria pollutants: carbon monoxide, nitrogen dioxide, sulfur dioxide, lead, ozone, and particulate matter (PM_{10} and $PM_{2.5}$). Hawaii has also established a state ambient air standard for hydrogen sulfide. The primary purpose of the statewide monitoring network is to measure ambient air concentrations of these pollutants and ensure that these air quality standards are met. The stations are maintained and the data are collected by the Air Surveillance and Analysis Section of the State Laboratories Division.

In 2003, the State of Hawaii began participating in the national $PM_{2.5}$ speciation monitoring program. When EPA re-evaluated the particulate matter NAAQS, it was determined that chemical speciation was essential for establishing a relationship between particle concentrations and adverse health effects. Additionally, speciation data would also provide valuable information for characterizing aerosols, determining the effectiveness of control strategies, and in understanding the effects of particle pollution on atmospheric and regional haze. The speciation monitor for Hawaii is located at the Pearl City air monitoring station.

Air pollution is caused by many different man-made and natural sources. There are industrial sources of pollution, such as power plants and refineries; mobile sources, such as cars, trucks, and buses; agricultural sources, such as cane burning; and natural sources, such as windblown dust and volcanic activity. In 2005, the state maintained 16 air monitoring stations on 4 islands. Most commercial, industrial, and transportation activities and their associated air quality effects occur on Oahu, where 9 of the stations are located. Maui and Kauai each have one monitoring station, mainly to measure the air quality impacts from agricultural activities. The continuing eruption of the Kilauea Volcano and air quality impacts associated with geothermal energy production are being monitored at five stations on the island of Hawaii. The state's ambient air monitoring network is reviewed annually and relocations, additions and/or discontinuations can occur in the future as the need arises.

This report summarizes the validated air pollutant data collected at the 16 monitoring stations during calendar year 2005. Tabular summaries are provided which compare the measured concentrations of criteria pollutants with federal ambient air quality standards and of hydrogen sulfide with the state standard. The 2005 speciation data is also included in this report. Trend summaries of pollutants that have at least five years of data are depicted graphically.

The Department of Health also has a web site that displays near real-time air quality data from certain monitoring stations on Oahu and the Big Island. Data is posted approximately two hours after collection and is updated throughout the day. The data has not been reviewed for quality assurance and is subject to change but provides the public with viewing access to current air pollutant and meteorological information. To view this data online, go to www.hawaii.gov/health/environmental/air/cab/index.html and link to "View the Online Air Quality Data."

To view this entire book as well as books from 2003 and 2004 online, go to: www.hawaii.gov/health/environmental/air/cab/index.html and link to "Hawaii Air Quality Data Book."

Questions or comments regarding data in this report and other air quality information should be addressed to:

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The Department of Health provides access to its programs and activities without regard to race, color, national origin (including language), age, sex, religion, or disability. Write or call our Affirmative Action Officer at Box 3378, Honolulu, HI 96801-3378 or at (808) 586-4616 (voice) within 180 days of a problem.

Front page photo is a view of Diamond Head on the island of Oahu as seen from Punchbowl Memorial Cemetery.

Section 2
DEFINITIONS

"Ambient Air": The general outdoor atmosphere, external to buildings, to which the general public has access.

"Ambient Air Quality": The quality or state of purity of the ambient air.

"Ambient Air Quality Standard": A limit in the quantity and exposure to pollutants dispersed or suspended in the ambient air. Primary standards are set to protect public health, including sensitive populations such as asthmatics, children, and the elderly. Secondary standards are set to protect public welfare including protection against visibility degradation, and damage to animals, crops, vegetation and buildings.

"Carbon Monoxide": Carbon monoxide (CO) is a colorless, odorless, tasteless gas under atmospheric conditions. It is produced by the incomplete combustion of carbon fuels with the majority of emissions coming from transportation sources.

"CFR": Code of Federal Regulations is the codification of the general and permanent rules published in the Federal Register by the executive departments and agencies of the Federal government. Title 40 is the Protection of the Environment.

"Collocated": Procedure required for a certain percentage of PM_{10} and $PM_{2.5}$ samplers in the monitoring network. Collocated samplers determine precision or variation in the PM_{10} or $PM_{2.5}$ concentration measurements of identical samplers run in the same location under the same sampling conditions.

"Criteria Pollutants": The six pollutants for which the EPA has established national air quality standards. The pollutants are ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, Lead and Particulate Matter (PM_{10} and $PM_{2.5}$).

"EPA": The United States Environmental Protection Agency. A federal agency established to protect human health and the natural environment.

"Hydrogen Sulfide": Hydrogen sulfide (H_2S) is a toxic, colorless gas with a characteristic "rotten egg" odor detectable at very low levels. Also known as sewer gas, it is naturally occurring from sources such as volcanic activity, geothermal energy exploration and bacterial decomposition of organic matter.

"$\mu g/m^3$": Micrograms per cubic meter. This is the measurement of air quality expressed as mass per unit volume.

"NAAQS": National Ambient Air Quality Standards. These are pollutant standards that the EPA has established to protect public health and welfare. NAAQS have been set for carbon monoxide, nitrogen dioxide, PM_{10}, $PM_{2.5}$, ozone, sulfur dioxide, and lead. These are commonly referred to as criteria pollutants.

"NAMS": National Air Monitoring Stations. A subset of the SLAMS network, these sites are used to track trends in certain pollutants and must meet more stringent siting requirements, equipment type, and quality assurance criteria.

"Nitrogen Dioxide": Nitrogen dioxide (NO_2) is a brownish, highly corrosive gas with a pungent odor. It is formed in the atmosphere from emissions of nitrogen oxides (NO_x). Sources of nitrogen oxides include electric utilities, industrial boilers, motor vehicle exhaust and combustion of fossil fuels. NO_2 is also a component in the atmospheric reaction that produces ground-level ozone.

"Ozone": Ozone (O_3) is the main constituent in photochemical air pollution. It is formed in the atmosphere by a chemical reaction of nitrogen oxides (NO_x) and volatile organic compounds (VOCs) in the presence of sunlight. In the upper atmosphere, O_3 shields the earth from harmful ultraviolet radiation; however, at ground level, it can cause harmful effects in humans and plants.

"Particulate Matter": Any dispersed matter, solid or liquid, in which the individual aggregates are larger than the single molecules in diameter, but smaller than 500 microns. Particulate matter (PM) includes dust, soot, smoke, and liquid droplets from sources such as factories, power plants, motor vehicles, construction, agricultural activities, and fires.

"PM_{10}": Particulate matter that is 10 microns or less in aerodynamic diameter. These are considered "coarse" particles generally from sources such as road and windblown dust, and crushing and grinding operations.

"$PM_{2.5}$": Particulate matter that is 2.5 microns or less in aerodynamic diameter. Considered "fine" particles, these are generally a result of fuel combustion such as from motor vehicles, utility generation and industrial facilities. Fine particles can also be formed when gases, such as sulfur dioxide and nitrogen dioxide, are chemically transformed into particles.

"SLAMS": State and Local Air Monitoring Stations. The Clean Air Act requires that every state establish a network of air monitoring stations for criteria pollutants, using requirements set by the EPA Office of Air Quality Planning and Standards.

"Speciation": Part of the $PM_{2.5}$ monitoring program, samples are analyzed for concentrations of selected ions, metals, carbon species, and organic compounds.

"Sulfur Dioxide": Sulfur dioxide (SO_2) is a colorless gas that easily combines with water vapor forming sulfuric acid. When sulfur dioxide mixes with atmospheric moisture, the result is commonly known as acid rain. Emissions of sulfur dioxide are largely from sources that burn fossil fuels such as coal and oil. In Hawaii, another major source of sulfur dioxide emissions is from the eruption of Kilauea Volcano on the Big Island.

"Vog": Vog is a local term used when volcanic gas and particles combine with air and sunlight to produce atmospheric haze.

Table 2-1 **State and Federal Ambient Air Quality Standards**

Primary Standards set limits to protect public health, including the health of "sensitive" populations such as asthmatics, children and the elderly.
Secondary Standards set limits to protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings.

Sources: State standards HAR §11-59; Federal standards 40 CFR Part 50

Air Pollutant	Averaging Time	Standards		
		Hawaii State Standard ($\mu g/m^3$)	Federal Primary Standard ($\mu g/m^3$)	Federal Secondary Standard ($\mu g/m^3$)
Carbon Monoxide	1-hour	10,000	40,000	40,000
	8-hour	5,000	10,000	10,000
Nitrogen Dioxide	Annual	70	100	100
PM_{10}	24-hour	150	150	150
	Annual	50	50	50
$PM_{2.5}$	24-hour		65	65
	Annual		15	15
Ozone	1-hour	---	235	235
	8-hour	157	157	157
Sulfur Dioxide	3-hour	1,300	---	1,300
	24-hour	365	365	---
	Annual	80	80	---
Lead [a]	Calendar Quarter	1.5	1.5	1.5
Hydrogen Sulfide	1-hour	35	---	---

[a] Ambient air monitoring for lead was discontinued in October 1997 with EPA approval. Levels in the state were far below the federal standard since sampling began. With the elimination of lead in gasoline, concentrations were consistently zero or nearly zero. However, lead has been measured since 2003 as part of the $PM_{2.5}$ speciation monitoring program.

Compliance with Air Quality Standards

Carbon Monoxide 1-hour: May not be exceeded more than once per year.
Carbon Monoxide 8-hour: Computed as a moving average, may not be exceeded more than once per year.
Nitrogen Dioxide Annual: Average of all 1-hour values in the year may not exceed the level of the standard.
PM_{10} 24-hour: May not be exceeded more than one day per year, after compensating for days when monitoring did not occur (estimated number of exceedances)
PM_{10} Annual: Average of all 24-hour values in the year may not exceed the level of the standard.
$PM_{2.5}$ 24-hour: The 98^{th} percentile of 24-hour values for the year may not exceed the level of the standard. (The 98^{th} percentile 24-hour value is the value that is higher than 98 percent of all 24-hour values for the year.)
$PM_{2.5}$ Annual: Average of all 24-hour values in the year may not exceed the level of the standard.
Ozone 1-hour: May not be exceeded more than one day per year, after compensating for missing data (estimated number of exceedances)
Ozone 8-hour: Computed as a moving average, the fourth highest value in the year may not exceed the level of the standard.
Sulfur Dioxide 3-hour: May not be exceeded more than once per year.
Sulfur Dioxide 24-hour: May not be exceeded more than once per year.
Sulfur Dioxide Annual: Average of all 1-hour values in the year may not exceed the level of the standard.
Lead Quarter: Average of all 24-hour values in any calendar quarter may not exceed the level of the standard.

Section 3
SITE LOCATIONS AND DESCRIPTIONS

This section provides detailed descriptions of the monitoring stations in the State of Hawaii. Table 3-1 lists the air pollutant(s) measured at each monitoring station, characterizes the area surrounding the station, and indicates the start dates for air monitoring at the station. Table 3-2 identifies the type of sampler used to measure the concentration of each criteria air pollutant. Figures 3-1, 3-2, 3-3 and 3-4 are maps showing the location of each monitoring station on the islands of Oahu, Kauai, Maui and Hawaii, respectively.

Except for the Puna H station on the Big Island, coordinates for all stations were collected using a carrier phase global positioning system (GPS) with a mapping accuracy of approximately one meter. The coordinates for the Puna H station were collected using a handheld GPS with a mapping accuracy of approximately seven meters.

ISLAND OF OAHU

1. Honolulu

Location description:	In downtown Honolulu, on the roof of the Department of Health building (Kinau Hale) at 1250 Punchbowl Street.
Area description:	Across from a major hospital (Queen's Medical Center) in a business and government district.
Pollutants monitored:	CO, SO_2, PM_{10}, and $PM_{2.5}$
Latitude/Longitude:	21°18'27.27098" N 157°51'19.52241" W
Altitude (meters):	20 m above mean sea level

2. Kapolei

Location description: In the Kapolei Business Park at 2052 Lauwiliwili Street, near the entrance to Campbell Industrial Park.

Area description: Commercial and industrial area with nearby residential and agricultural lands. Located near the Kapolei Fire Station.

Pollutants monitored: CO, SO_2, NO_2, PM_{10}, and $PM_{2.5}$

Latitude/Longitude: 21°19'25.48126" N 158°05'19.00562" W

Altitude (meters): 17.9 m above mean sea level

3. Liliha

Location description: On top of the single story administration building of Kauluwela Elementary School at 1486 Aala Street in downtown Honolulu.

Area description: Mostly a residential and commercial area downwind of the heavily traveled H-1 freeway.

Pollutants monitored: PM_{10}

Latitude/Longitude: 21°19'08.57706" N 157°51'31.84786" W

Altitude (meters): 17.9 m above mean sea level

4. Makaiwa

Location description: In Kapolei, at 92-670 Farrington Highway, approximately one mile southeast of Hawaiian Electric Company's Kahe power plant and across from the Honokai Hale subdivision.

Area description: Residential, industrial and agricultural area, approximately 25 miles west of downtown Honolulu.

Pollutants monitored: SO_2

Latitude/Longitude: 21°20'39.36299" N 158°06'46.67939" W

Altitude (meters): 50.9 m above mean sea level

5. Pearl City

Location description: Atop the Leeward Health Center at 860 Fourth Street, Pearl City, approximately 9.5 miles northwest of downtown Honolulu. Approximately 1.5 miles northwest of Hawaiian Electric Company's Waiau power plant and near the naval facilities of Pearl Harbor.

Area description: Commercial, industrial and residential area bordered by the busy Kamehameha highway and H-1 freeway.

Pollutants monitored: PM_{10}, $PM_{2.5}$, and $PM_{2.5}$ speciation

Latitude/Longitude: 21°23'34.19856" N 157°58'08.85360" W

Altitude (meters): 23.1 m above mean sea level

6. Sand Island

Location description: At the University of Hawaii's Anuenue Fisheries in the Sand Island Industrial Park.

Area description: Light industrial, commercial and recreational area approximately two miles southwest (typically downwind) of downtown Honolulu and near the entrance to the Sand Island State Recreation Area.

Pollutants monitored: O_3 and $PM_{2.5}$

Latitude/Longitude: 21°18'13.81750" N 157°52'16.21590" W

Altitude (meters): 5.3 m above mean sea level

7. University

Location description: On the second floor of the University Square building at 2617 South King Street near the University of Hawaii.

Area description: Mostly commercial and residential area with apartments, restaurants and shops. Bordered by three busy streets; South King Street, South Beretania Street and University Avenue.

Pollutants monitored: CO

Latitude/Longitude: 21°17'29.66208" N 157°49'17.37281" W

Altitude (meters): 4.7 m above mean sea level

8. Waimanalo

Location description:	Within the Waimanalo Wastewater Treatment Facility at 41-1060 Kalanianaole Highway approximately 10 miles east-northeast of downtown Honolulu on the windward (upwind) side of Oahu.
Area description:	Rural, agricultural community
Pollutants monitored:	PM_{10}
Latitude/Longitude:	21°20'16.21667" N 157°42'16.6539" W
Altitude (meters):	6.7 m above mean sea level

9. West Beach

Location description:	Within the Ko'Olina Golf Course approximately 27 miles west of downtown Honolulu and 1.5 miles northwest of Campbell Industrial Park.
Area description:	Resort, recreational, and residential area just north of the Barber's Point Deep Draft Harbor in Kapolei.
Pollutants monitored:	SO_2, NO_2, PM_{10}
Latitude/Longitude:	21°19'57.87475" N 158°06'50.86663" W
Altitude (meters):	14.5 m above mean sea level

ISLAND OF KAUAI

Lihue

Location description: In downtown Lihue, on the roof of the District Health Office at 3040 Umi Street.
Area description: Commercial, residential area with nearby agricultural lands
Pollutants monitored: PM_{10}
Latitude/Longitude: 21°58'28.89947" N 159°21'58.09671" W
Altitude (meters): 71.1 m above mean sea level

ISLAND OF MAUI

Kihei

Location description: In upper Kihei within the Hale Piilani Park, bordered on the north by agricultural land.
Area description: Residential and agricultural area. The predominant agricultural activity is growing and harvesting sugar cane.
Pollutants monitored: PM_{10}, $PM_{2.5}$
Latitude/Longitude: 20°46'51.58844" N 156°26'46.94337" W
Altitude (meters): 46.5 m above mean sea level

ISLAND OF HAWAII

1. Hilo

Location description: On the grounds of the Adult Rehabilitation Center of Hilo at 1099 Waianuenue Avenue, near the Hilo Medical Center.
Area description: Business and residential area in Hilo.
Pollutants monitored: SO_2
Latitude/Longitude: 19°43'03.22398" N 155°06'37.90606" W
Altitude (meters): 136.76 m above mean sea level

2. Kona

Location description: Originally on the lower campus baseball field at Konawaena High School at 81-1043 Konawaena School Road in Kealakekua, Hawaii. The station was shut down in July due to renovations of the baseball field and was moved to the upper campus.
Area description: Mostly residential and agricultural area in Kealakekua.
Pollutants monitored: SO_2
Latitude/Longitude: 19°30'27.83302" N 155°55'03.67861" W (Jan - July)
19°30'35.2" N 155°54'48.3" W (since Sept.)
Altitude (meters): 479.61 m above mean sea level (Jan – July)
517.25 m above mean sea level (since Sept.)

3. Lava Tree

Location description: On the eastern border of the Lava Tree State Park near Nanawale Estates
Area description: Sparse residential and agricultural area
Pollutants monitored: H_2S
Latitude/Longitude: 19°29’11.06393” N 154°54’11.22523” W
Altitude (meters): 192.65 m above mean sea level

4. Puna E

Location description: In the Leilani Estates residential subdivision in Puna
Area description: Sparse residential and agricultural area, approximately 1.5 miles southwest of the Puna Geothermal Venture power plant.
Pollutants monitored: H_2S, SO_2
Latitude/Longitude: 19°27’50.3594” N 154°53’55.34089” W
Altitude (meters): 207.86 m above mean sea level

5. Puna H

Location description:	Located in the Lanipuna Gardens subdivision in Puna
Area description:	Sparse residential and agricultural area approximately one-half mile south-southwest from the Puna Geothermal Venture power plant
Pollutants monitored:	H_2S
Latitude/Longitude:	19°28’18.6” N 154°53’20.5” W
Altitude (meters):	188.98 m above mean sea level

Table 3-1 **State of Hawaii Air Monitoring Network**

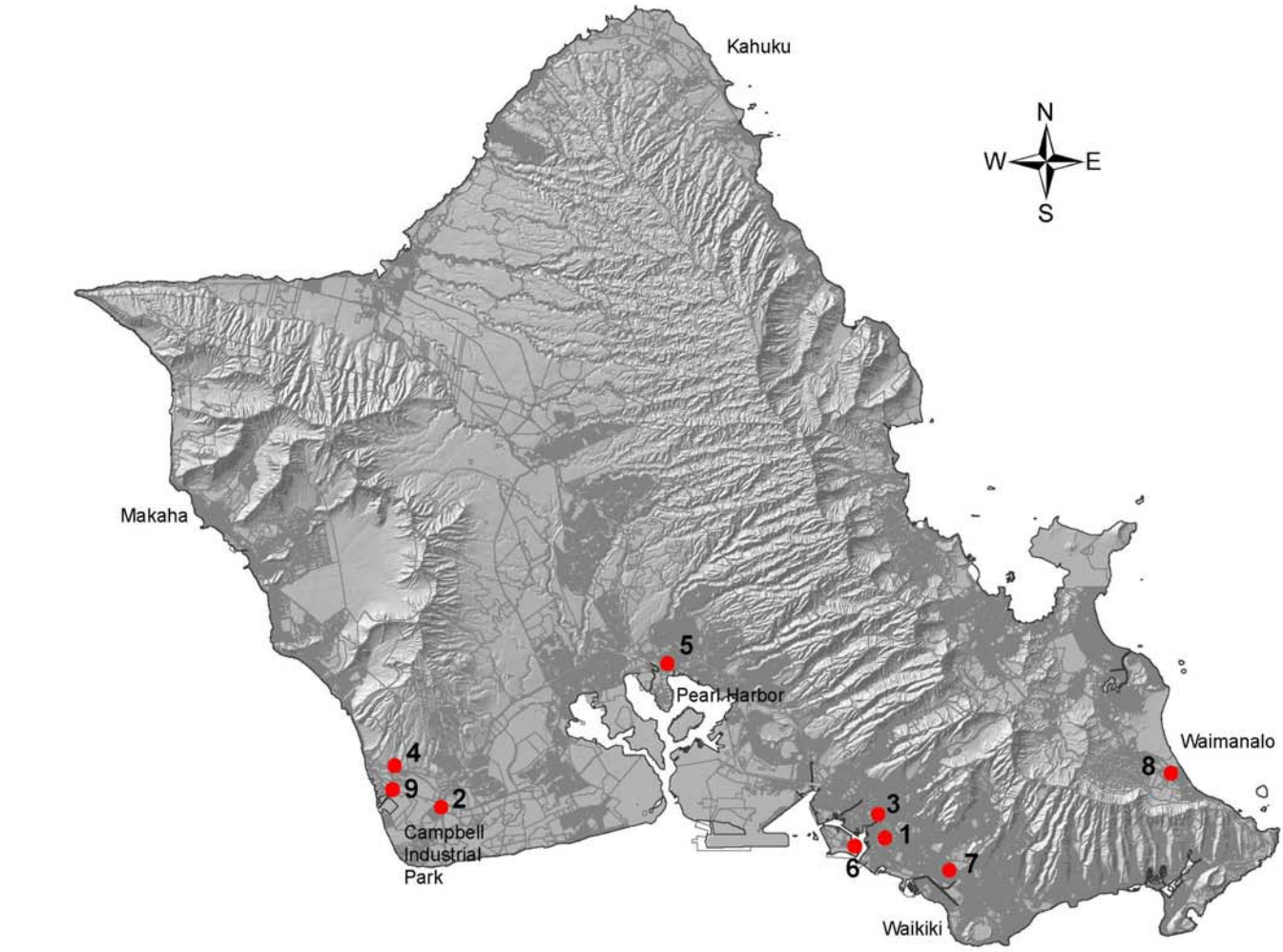
	Station Type								
SITE	**PM_{10}**	**$PM_{2.5}$**	**CO**	**O_3**	**SO_2**	**NO_2**	**H_2S**	**LOCATION SETTING**	**ESTABLISHED**
OAHU									
Honolulu	S	S, C	N	-	S	-	-	Urban & Center City	January 1960
Kapolei	S	S	S	-	S	S	-	Industrial	February 1991
Liliha	N	-	-	-	-	-	-	Urban & Center City	January 1984
Makaiwa	-	-	-	-	S	-	-	Industrial	July 1989
Pearl City	S	S,C	-	-	-	-	-	Urban & Center City	May 1979
Sand Island	-	S	-	N	-	-	-	Urban & Center City	January 1980
University	-	-	S	-	-	-	-	Urban & Center City	November 2002
Waimanalo	S	-	-	-	-	-	-	Agricultural	January 1972
West Beach	S	-	-	-	S	S	-	Commercial	February 1991
KAUAI									
Lihue	S	-	-	-	-	-	-	Urban & Center City	January 1972
MAUI									
Kihei	SPM	S	-	-	-	-	-	Suburban	February 1999
HAWAII									
Hilo	-	-	-	-	SPM	-	-	Center City	March 1995
Kona	-	-	-	-	SPM	-	-	Suburban	April 1997
Lava Tree	-	-	-	-	-	-	SPM	Rural / Agricultural	August 1993
Puna E	-	-	-	-	SPM	-	SPM	Rural / Agricultural	March 1991
Puna H	-	-	-	-	-	-	SPM	Rural / Agricultural	November 2002

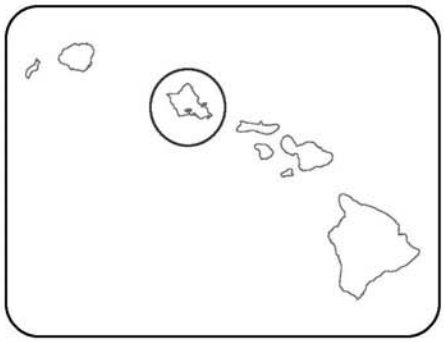
N = (NAMS) National Air Monitoring Station
C = Collocated Site
S = (SLAMS) State and Local Air Monitoring Station
SPM = Special Purpose Monitoring Station, (for monitoring vog, geothermal energy production, or cane burning)

Table 3-2 **Sampling Equipment at Each Monitoring Station**

Monitoring Station	Sampling Method (Criteria Pollutants and H_2S)							
	PM_{10} Continuous Ambient Particulate Monitor	PM_{10} Manual Ambient Particulate Monitor (1 in 6 days)	$PM_{2.5}$ Manual Ambient Particulate Monitor	CO Continuous Gas Filter Correlation Analyzer	SO_2 Continuous Pulsed Fluorescence Ambient Air Analyzer	O_3 Continuous UV Photometric Analyzer	NO_2 Continuous Chemiluminescence Analyzer	H_2S Continuous Pulsed Fluorescence Ambient Air Analyzer
OAHU Honolulu	✓		✓ (daily)	✓	✓			
Kapolei	✓		✓ (1 in 3 days)	✓	✓		✓	
Liliha	✓							
Makaiwa					✓			
Pearl City	✓		✓(daily)					
Sand Island			✓(1 in 6 days)			✓		
University				✓				
Waimanalo	✓(1/1 to 5/31)	✓(6/1 to 12/31)						
West Beach		✓			✓		✓	
KAUAI Lihue	✓(5/25 to 12/31)	✓(1/1 to 5/22)						
MAUI Kihei	✓		✓ (1 in 3 days)					
HAWAII Hilo					✓			
Kona					✓			
Lava Tree								✓
Puna E					✓			✓
Puna H								✓

Figure 3-1: Island of Oahu - Air Monitoring Stations





Station	Name	Location	Pollutants_Monitored
1	Honolulu	1250 Punchbowl St.	PM_{10}, $PM_{2.5}$, CO, SO_2
2	Kapolei	2052 Lauwiliwili St.	PM_{10}, $PM_{2.5}$, CO, SO_2, NO_2
3	Liliha	1486 Aala St.	PM_{10}
4	Makaiwa	92-670 Farrington Hwy.	SO_2
5	Pearl City	860 4th St.	PM_{10}, $PM_{2.5}$, $PM_{2.5}$ speciation
6	Sand Island	UH Anuenue Fisheries	O_3, $PM_{2.5}$
7	University	2617 S. King St.	CO
8	Waimanalo	41-1060 Kalanianaole Hwy.	PM_{10}
9	West Beach	Ko'Olina Golf Course	PM_{10}, SO_2, NO_2

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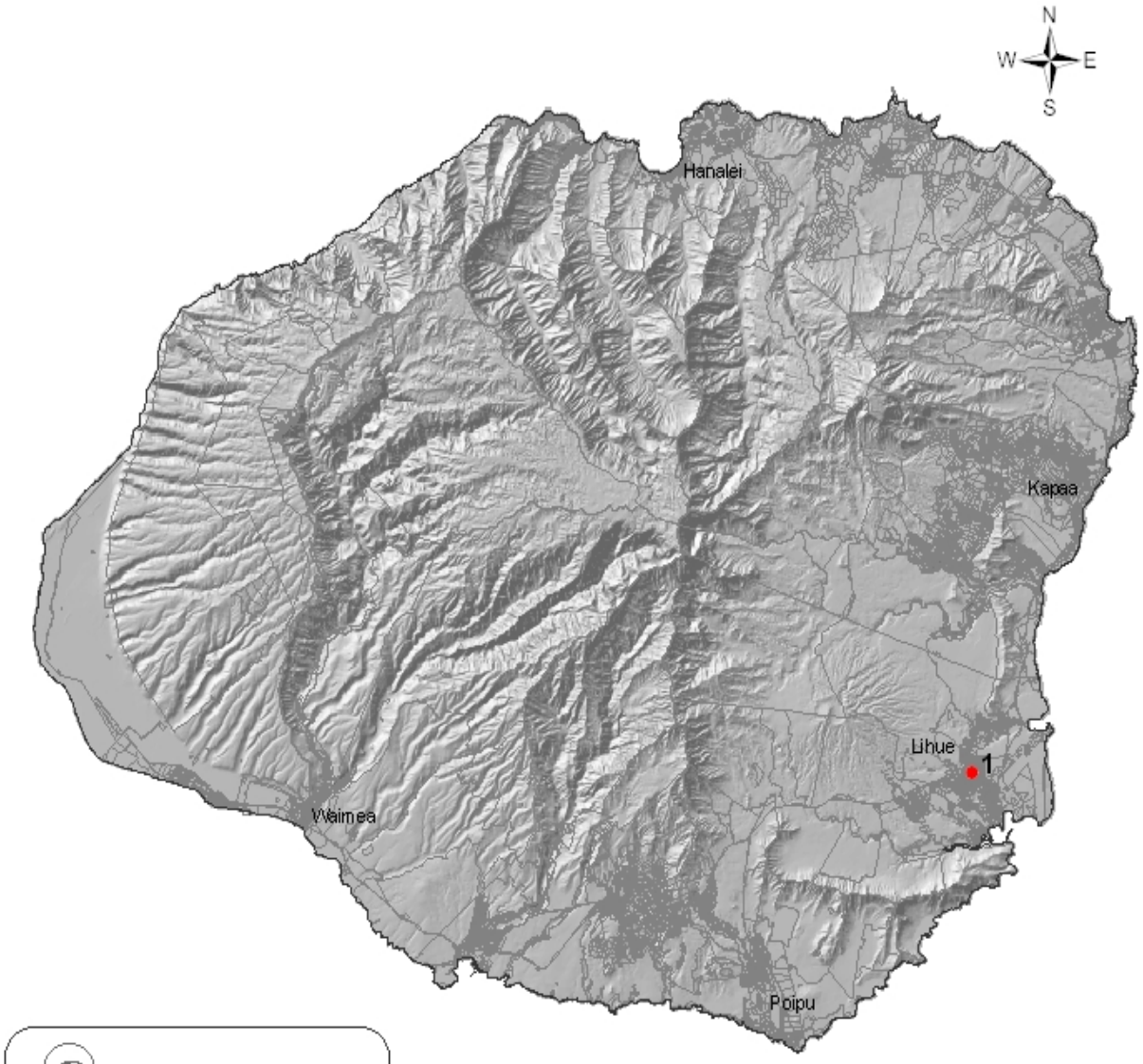
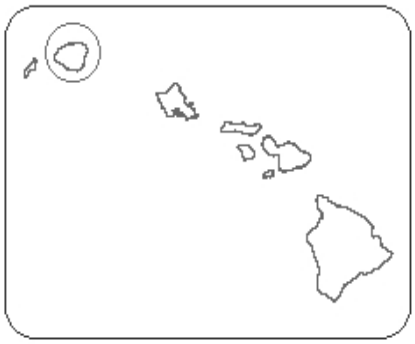
Figure 3-2: Island of Kauai - Air Monitoring Station





Station	Name	Location	Pollutants_Monitored
1	Lihue	3040 Umi St.	PM_{10}

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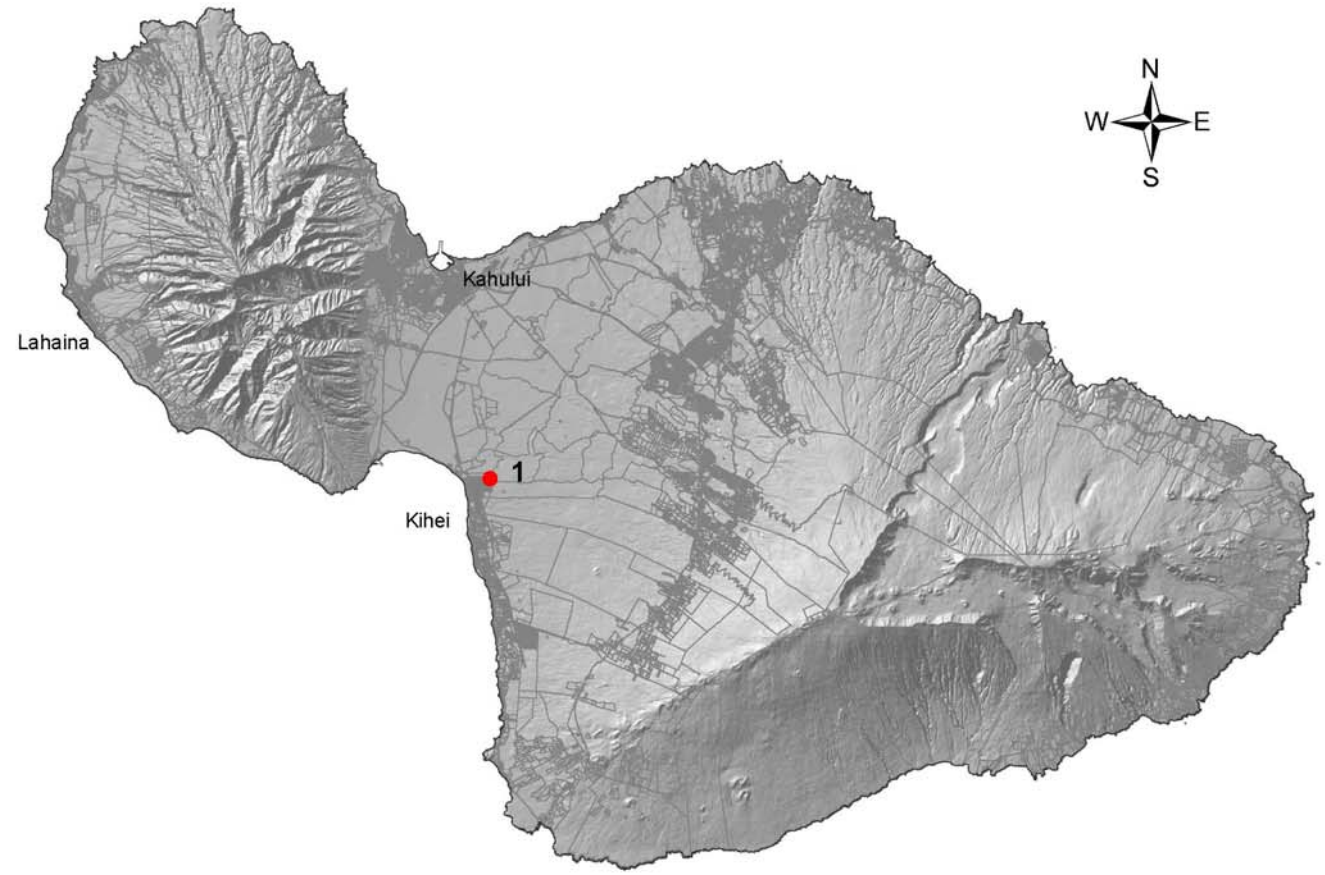
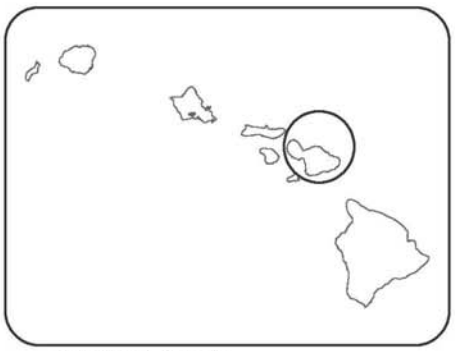
Figure 3-3: Island of Maui - Air Monitoring Station





0 2.5 5 10 Miles

Station	Name	Location	Pollutants_Monitored
1	Kihei	Hale Piilani Park	PM_{10}, $PM_{2.5}$

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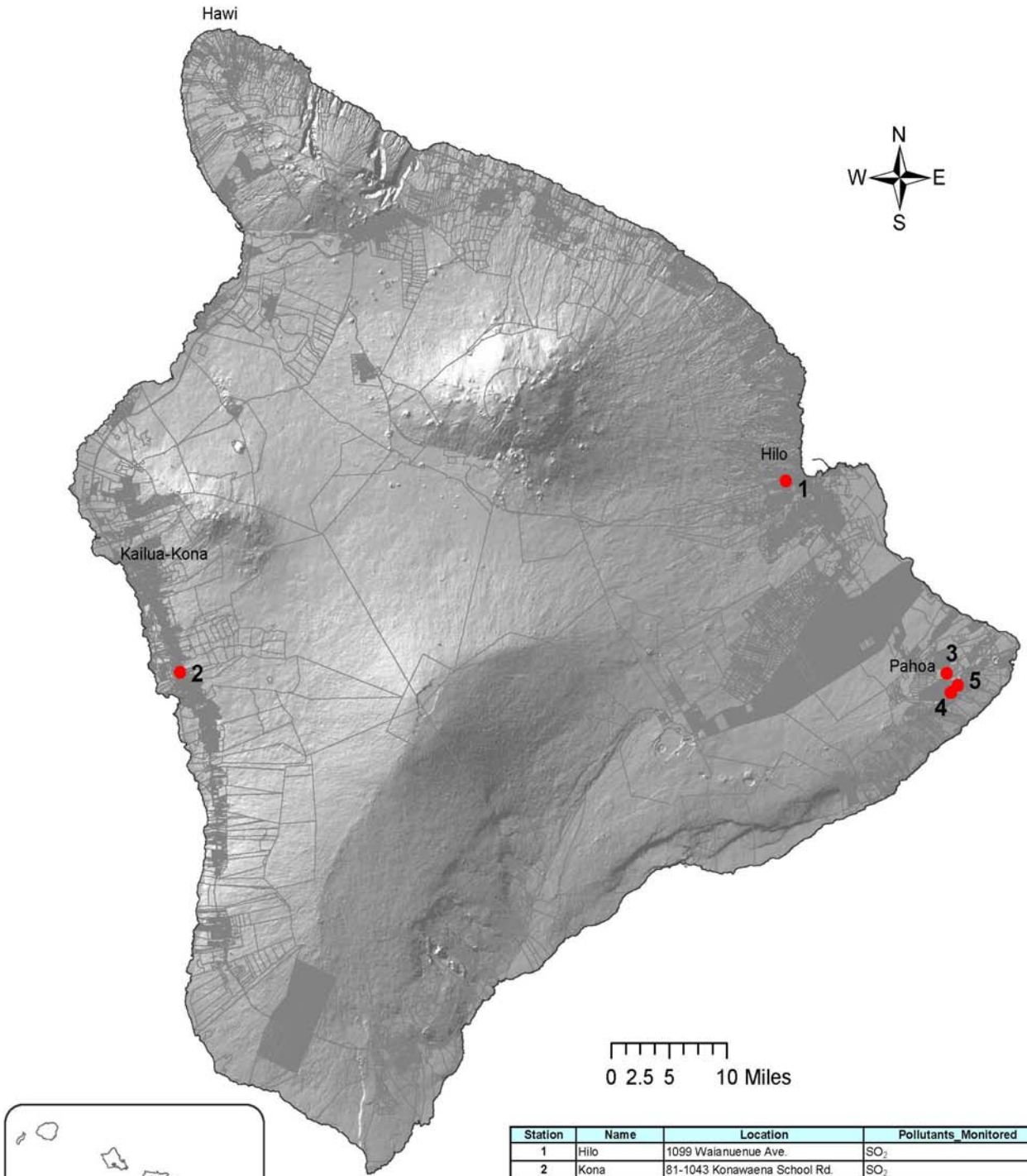
Figure 3-4: Island of Hawaii - Air Monitoring Stations



Station	Name	Location	Pollutants_Monitored
1	Hilo	1099 Waianuenue Ave.	SO_2
2	Kona	81-1043 Konawaena School Rd.	SO_2
3	Lava Tree	Near Lava Tree State Park	H_2S
4	Puna E	Leilani Subdivision	SO_2, H_2S
5	Puna H	Lanipuna Subdivision	H_2S

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Section 4
2005 AIR QUALITY DATA

To protect the state's air quality from degradation, the Department of Health's Clean Air Branch is responsible for regulating and monitoring pollution sources to ensure that the levels of criteria pollutants remain well below the state and federal ambient air quality standards. Data collected from the ambient air network is audited by the Air Surveillance and Analysis Section to ensure that the reported data is of good quality and meets all quality control and assurance requirements.

The following tables summarize the pollutant concentrations measured at each monitoring station. Tables 4-1 through 4-10 are annual summaries grouped by pollutant and provide the number of occurrences exceeding the NAAQS. There is no federal ambient air quality standard for H_2S, and Table 4-10 provides the number of occurrences exceeding the state standard.

The annual statistics provided in tables 4-1 and 4-3 through 4-10 are the highest and second highest $\mu g/m^3$ values recorded in the year for the averaging period, and the annual means, which is the arithmetic mean of all valid hours recorded in the year. The "Possible Periods" is the total number of sampling periods in the year for the averaging time, "Valid Periods" is the total number of acceptable sampling periods after data validation, and "Percent Recovery" represents the amount of quality data reported. Compliance with the 24-hour $PM_{2.5}$ NAAQS is determined by computing the 98^{th} percentile value which must not exceed the level of the standard. The annual statistics in Table 4-2 are the highest and 98^{th} percentile $\mu g/m^3$ values recorded in the year for all stations monitoring for $PM_{2.5}$.

Tables 4-11 through 4-20 are monthly summaries of the range and average of each pollutant for each averaging period. The range is the lowest and highest $\mu g/m^3$ values recorded in the month for the averaging period and the average is the arithmetic mean of all hours recorded in the month. The month with the highest value recorded in the year for each site is highlighted.

There was one SLAMS PM_{10} 24-hour exceedance at the Pearl City station attributed to New Year's fireworks and one SPM PM_{10} 24-hour exceedance at the Kihei station attributed to agricultural tilling. Both of these exceedances have been flagged as "Exceptional Events".

In 2005, the State of Hawaii was in attainment for all NAAQS.

Table 4-1 **Annual Summary of 24-Hour PM_{10}**

	Annual Statistics																	
	Maximum		Annual Means	24-hour Occurrences Greater than 150 µg/m^3														
	1st High	2nd High	All Hours	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Possible Periods	Valid Periods	Percent Recovery
OAHU																		
Honolulu[a]	64[b]	28	15	0	0	0	0	0	0	0	0	0	0	0	0	365	173	47
Kapolei	53[b]	36	15	0	0	0	0	0	0	0	0	0	0	0	0	365	352	96
Liliha	94[b]	32[b]	16	0	0	0	0	0	0	0	0	0	0	0	0	365	352	96
Makaiwa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pearl City	195[b]	99[b]	16	1[b]	0	0	0	0	0	0	0	0	0	0	0	365	336	92
Sand Island	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
University	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waimanalo[d]	52	48	24	0	0	0	0	0	-	-	-	-	-	-	-	151	109	72
Waimanalo[c,d]	21	21	13	-	-	-	-	-	0	0	0	0	0	0	0	36	36	100
West Beach[c]	33	25	12	0	0	0	0	0	0	0	0	0	0	0	0	61	60	98
KAUAI																		
Lihue [c,e]	24	23	15	0	0	0	0	0	-	-	-	-	-	-	-	24	19	79
Lihue[e]	30	28	14	-	-	-	-	-	0	0	0	0	0	0	0	221	195	88
MAUI																		
Kihei	155[f]	119	25	0	0	0	0	0	0	1[f]	0	0	0	0	0	365	337	92
HAWAII																		
Hilo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kona	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lava Tree	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Puna E	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Puna H	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

[a] Station shut down 7/14 for re-roofing [b] Data flagged, due to fireworks [c] Sampling is once every 6th day [d] Continuous monitor from 1/1 to 5/31; manual sampler from 6/1
[e] Manual sampler from 1/1 to 5/22; continuous monitor from 5/25 [f] Data flagged, due to agricultural tilling

Table 4-2 **Annual Summary of 24-Hour $PM_{2.5}$**

	Annual Statistics																	
	Maximum		Annual Means	98th Percentile 24-hour Occurrences Greater than 65 µg/m3														
	1st High	98th %	All Hours	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Possible Periods	Valid Periods	Percent Recovery
OAHU																		
Honolulu[a]	45[b]	13	4	0	0	0	0	0	0	0	0	0	0	0	0	365	179	49
Kapolei[c]	55[b]	11	4	0	0	0	0	0	0	0	0	0	0	0	0	122	108	89
Liliha	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Makaiwa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pearl City	88[b]	10	4	0	0	0	0	0	0	0	0	0	0	0	0	365	335	92
Sand Island[d]	13	10	5	0	0	0	0	0	0	0	0	0	0	0	0	61	56	92
University	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waimanalo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
West Beach	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KAUAI																		
Lihue	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAUI																		
Kihei[c]	10	8	5	0	0	0	0	0	0	0	0	0	0	0	0	122	108	89
HAWAII																		
Hilo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kona	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lava Tree	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Puna E	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Puna H	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

[a] Station shut down 7/14 for re-roofing [b] Data flagged, due to fireworks [c] Sampling is once every 3 days [d] Sampling is once every 6 days

Table 4-3 **Annual Summary of Nitrogen Dioxide**

Annual Statistics

	Maximum 1-hr		Annual Means	Annual Occurrences Greater than 100 µg/m^3														
	1st High	2nd High	All Hours	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Possible Periods	Valid Periods	Percent Recovery
OAHU																		
Honolulu	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kapolei	70	62	9	-	-	-	-	-	-	-	-	-	-	-	0	8760	8660	99
Liliha	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Makaiwa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pearl City	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sand Island	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
University	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Waimanalo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
West Beach	73	68	6	-	-	-	-	-	-	-	-	-	-	-	0	8760	8087	92
KAUAI																		
Lihue	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAUI																		
Kihei	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HAWAII																		
Hilo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kona	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lava Tree	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Puna E	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Puna H	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 4-4 **Annual Summary of 1-Hour Carbon Monoxide**

	Annual Statistics																	
	Maximum		Annual Means	1-hour Occurrences Greater than 40,000 µg/m^3														
	1st High	2nd High	All Hours	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Possible Periods	Valid Periods	Percent Recovery
OAHU																		
Honolulu[a]	3876	3078	630	0	0	0	0	0	0	0	0	0	0	0	0	8760	4197	48
Kapolei	1710	1596	401	0	0	0	0	0	0	0	0	0	0	0	0	8760	8556	98
Liliha	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Makaiwa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pearl City	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sand Island	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
University	3078	2850	707	0	0	0	0	0	0	0	0	0	0	0	0	8760	8667	99
Waimanalo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
West Beach	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KAUAI																		
Lihue	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAUI																		
Kihei	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HAWAII																		
Hilo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kona	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lava Tree	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Puna E	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Puna H	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

[a] Station shut down 7/14 for re-roofing

Table 4-5 **Annual Summary of 8-Hour Carbon Monoxide**

	Annual Statistics																	
	Maximum		Annual Means	8-hour Occurrences Greater than 10,000 µg/m^3														
	1st High	2nd High	All Hours	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Possible Periods	Valid Periods	Percent Recovery
OAHU																		
Honolulu[a]	1610	1596	630	0	0	0	0	0	0	0	0	0	0	0	0	8760	4180	48
Kapolei	1055	1040	401	0	0	0	0	0	0	0	0	0	0	0	0	8760	8551	98
Liliha	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Makaiwa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pearl City	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sand Island	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
University	1895	1895	707	0	0	0	0	0	0	0	0	0	0	0	0	8760	8648	99
Waimanalo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
West Beach	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KAUAI																		
Lihue	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAUI																		
Kihei	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HAWAII																		
Hilo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kona	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lava Tree	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Puna E	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Puna H	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

[a] Station shut down 7/14 for re-roofing

Table 4-6 **Annual Summary of 3-Hour Sulfur Dioxide**

Annual Statistics

	Maximum		Annual Means	3-hour Occurrences Greater than 1,300 µg/m^3														
	1st High	2nd High	All Hours	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Possible Periods	Valid Periods	Percent Recovery
OAHU																		
Honolulu[a]	75	57	1	0	0	0	0	0	0	0	0	0	0	0	0	2920	1483	51
Kapolei	64	28	2	0	0	0	0	0	0	0	0	0	0	0	0	2920	2396	82
Liliha	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Makaiwa	70	61	4	0	0	0	0	0	0	0	0	0	0	0	0	2920	2829	97
Pearl City	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sand Island	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
University	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waimanalo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
West Beach	40	18	2	0	0	0	0	0	0	0	0	0	0	0	0	2920	2521	86
KAUAI																		
Lihue	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAUI																		
Kihei	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HAWAII																		
Hilo	733	560	11	0	0	0	0	0	0	0	0	0	0	0	0	2920	2856	98
Kona[b]	83	82	13	0	0	0	0	0	0	0	0	0	0	0	0	2920	2341	80
Lava Tree	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Puna E[c]	502	128	3	0	0	0	0	0	0	0	0	0	0	0	0	2547	2266	89
Puna H	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

[a] Station shu t down 7/14 for re-roofing [b] Station shut down 7/27, moved to upper campus and began operation again on 9/13 [c] SO_2 monitoring began 2/17

Table 4-7 **Annual Summary of 24-Hour Sulfur Dioxide**

	Annual Statistics																	
	Maximum		Annual Means	24-hour Occurrences Greater than 365 µg/m^3														
	1st High	2nd High	All Hours	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Possible Periods	Valid Periods	Percent Recovery
OAHU																		
Honolulu[a]	23	18	1	0	0	0	0	0	0	0	0	0	0	0	0	365	187	51
Kapolei	21	9	2	0	0	0	0	0	0	0	0	0	0	0	0	365	333	91
Liliha	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Makaiwa	19	19	4	0	0	0	0	0	0	0	0	0	0	0	0	365	359	98
Pearl City	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sand Island	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
University	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waimanalo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
West Beach	11	6	2	0	0	0	0	0	0	0	0	0	0	0	0	365	362	99
KAUAI																		
Lihue	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAUI																		
Kihei	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HAWAII																		
Hilo	253	128	11	0	0	0	0	0	0	0	0	0	0	0	0	365	362	99
Kona[b]	47	42	13	0	0	0	0	0	0	0	0	0	0	0	0	365	296	81
Lava Tree	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Puna E [c]	96	30	3	0	0	0	0	0	0	0	0	0	0	0	0	318	317	99
Puna H	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

[a] Station shut down 7/14 for re-roofing [b] Station shut down 7/27, moved to upper campus and began operation again on 9/13 [c] SO_2 monitoring began 2/17

Table 4-8 **Annual Summary of 1-Hour Ozone**

Annual Statistics

	Maximum		Annual Means	1-hour Occurrences Greater than 235 µg/m^3														
	1st High	2nd High	All Hours	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Possible Periods	Valid Periods	Percent Recovery
OAHU																		
Honolulu	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kapolei	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Liliha	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Makaiwa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pearl City	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sand Island	116	114	34	0	0	0	0	0	0	0	0	0	0	0	0	8760	8633	99
University	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waimanalo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
West Beach	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KAUAI																		
Lihue	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAUI																		
Kihei	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HAWAII																		
Hilo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kona	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lava Tree	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Puna E	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Puna H	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 4-9 **Annual Summary of 8-Hour Ozone**

	Annual Statistics [a]				8-hour Occurrences Greater than 157 µg/m^3														
	Maximum																		
	1st High	2nd High	4th High	All Hours	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Possible Periods	Valid Periods	Percent Recovery
OAHU																			
Honolulu	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kapolei	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Liliha	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Makaiwa	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pearl City	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sand Island	92	92	90	34	0	0	0	0	0	0	0	0	0	0	0	0	8760	8670	99
University	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waimanalo	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
West Beach	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KAUAI																			
Lihue	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAUI																			
Kihei	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HAWAII																			
Hilo	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kona	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lava Tree	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Puna E	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Puna H	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

[a] For compliance with the standard, the fourth highest value in a year may not exceed 157 µg/m^3

Table 4-10 **Annual Summary of 1-Hour Hydrogen Sulfide**

Annual Statistics

	Maximum		Annual Means	1-hour Occurrences Greater than 35 µg/m^3														
	1st High	2nd High	All Hours	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Possible Periods	Valid Periods	Percent Recovery
OAHU																		
Honolulu	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kapolei	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Liliha	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Makaiwa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pearl City	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sand Island	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
University	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waimanalo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
West Beach	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KAUAI																		
Lihue	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAUI																		
Kihei	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HAWAII																		
Hilo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kona	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lava Tree	13	13	1	0	0	0	0	0	0	0	0	0	0	0	0	8760	7935	91
Puna E	44	4	0	0	0	0	0	0	0	0	1	0	0	0	0	8760	8193	94
Puna H	4	3	0	0	0	0	0	0	0	0	0	0	0	0	0	8760	8332	95

Table 4-11 **Monthly Summary of 24-Hour PM_{10} ($\mu g/m^3$)**

The month with the highest annual value is highlighted **The state and federal 24-hr PM_{10} standards are 150 $\mu g/m^3$**

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Honolulu[a]	Range	9 – 64[b]	7 - 21	7 - 27	10 - 28	7 - 25	6 - 18	9 - 14					
	Average	17	13	16	17	14	14	11					
Kapolei	Range	9 – 53[b]	8 - 21	8 - 26	10 - 29	7 - 36	7 - 24	9 - 21	8 - 24	10 - 21	8 - 26	7 - 20	11 - 30
	Average	16	14	16	17	14	14	14	13	13	14	13	18
Liliha	Range	9 – 94[b]	8 - 23	7 - 28	12 - 30	9 - 25	9 - 21	9 - 18	9 - 18	9 - 17	9 - 18	8 - 20	10 - 32
	Average	20	15	17	19	15	15	14	13	13	14	15	19
Pearl City	Range	12 – 195[b]	12 - 33	12 - 34	11 - 28	8 - 22	7 - 19	10 - 18	7 - 17	8 - 17	8 - 21	8 - 25	7 – 99[b]
	Average	28	21	23	17	14	14	12	12	12	14	14	21
Waimanalo[c]	Range	9 - 28	8 - 34	11 - 45	23 - 52	7 - 17	12 - 17	9 - 13	4 - 14	9 - 21	8 - 19	6 - 15	12 - 21
	Average	19	22	23	34	13	15	11	9	14	15	11	18
West Beach (1 in 6 days)	Range	14 - 20	6 - 15	9 - 21	7 - 17	7 - 19	8 - 14	6 - 12	8 - 33	8 - 14	6 - 13	7 - 10	9 - 25
	Average	16	11	13	12	10	11	8	14	11	10	9	17
Lihue [d]	Range	9 - 18	8 - 15	4 - 24	14 - 19	8 - 23	13 - 28	9 - 27	6 - 18	8 - 20	6 - 30	2 - 25	4 - 24
	Average	14	11	15	17	16	22	18	11	13	14	11	11
Kihei	Range	7 - 24	11 - 27	5 - 26	14 - 32	12 - 38	12 - 80	18 – 155[e]	14 - 63	11 - 70	10 - 49	7 - 69	13 - 37
	Average	15	17	16	21	23	29	44	34	29	24	23	22

[a] Station shut down 7/14 for re-roofing [b] Data flagged due to fireworks [c] Continuous sampler from 1/1 to 5/31; manual 1 in 6 day sampler from 6/1

[d] Manual 1 in 6 day sampler from 1/1 to 5/22; continuous sampler from 5/25 [e] Data flagged due to Exceptional Events, “Agricultural Tilling”

Table 4-12 **Monthly Summary of 24-Hour $PM_{2.5}$ (µg/m^3)**

The month with the highest annual value is highlighted **The federal 24-hr $PM_{2.5}$ standard is 65 µg/m^3**

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Honolulu[a] (daily)	Range	3 – 45[b]	1 - 6	2 - 17	3 - 9	1 - 10	1 - 6	2 - 3					
	Average	6	3	5	5	4	3	2					
Kapolei (1 in 3 days)	Range	2 – 55[b]	2 - 5	1 - 7	2 - 6	1 - 9	2 - 4	1 - 8	0 - 3	3 - 8	2 - 8	2 - 5	2 - 11
	Average	12	3	4	4	4	3	3	2	4	3	4	6
Pearl City (daily)	Range	2 - 7	1 - 5	3 - 14	2 - 8	1 - 10	2 - 5	1 - 9	1 - 8	2 - 7	1 - 13	2 - 16	2 – 88[b]
	Average	4	3	6	5	4	3	3	3	4	3	4	8
Sand Island (1 in 6 days)	Range	4 - 10	3 - 5	5 - 8	3 - 10	3 - 7	3 - 4	3 - 6	3 - 4	2 - 7	3 - 6	3 - 7	2 - 13
	Average	6	4	6	6	5	4	4	4	5	5	5	7
Kihei (1 in 3 days)	Range	1 - 7	3 - 7	1 - 8	3 - 7	3 - 7	3 - 6	2 - 6	1 - 6	2 - 7	2 - 8	1 - 7	4 - 10
	Average	3	5	5	5	5	4	3	3	4	5	5	6

Compliance with the standard is determined by computing the 98th percentile value which may not exceed 65 µg/m^3

[a] Station shut down 7/14 for re-roofing

[b] Data flagged due to fireworks

Table 4-13 **Monthly Summary of 1-Hour Nitrogen Dioxide (µg/m^3)**

The month with the highest annual value is highlighted **There are no 1-hour state or federal standards for nitrogen dioxide**

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Kapolei	Range	4 - 38	2 - 34	2 - 39	2 - 32	0 - 32	0 - 39	0 - 30	2 - 28	2 - 30	2 - 34	4 - 49	4 - 70
	Average	12	8	9	7	6	6	8	9	9	10	12	16
West Beach	Range	0 - 49	0 - 55	0 - 73	0 - 47	0 - 30	0 - 21	0 - 24	2 - 45	0 - 30	2 - 34	0 - 32	0 - 68
	Average	6	6	6	5	5	5	5	8	6	7	8	7

Table 4-14 **Monthly Summary of 1-Hour Carbon Monoxide (µg/m^3)**

The month with the highest annual value is highlighted

The state 1-hr CO standard is 10,000 µg/m^3, the federal 1-hr CO standard is 40,000 µg/m^3

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Honolulu[a]	Range	570-2394	0-2280	0-3876	0-1140	114-1596	228-1254	456-1254					
	Average	1007	550	709	336	682	460	575					
Kapolei	Range	342-1368	342-1140	456-1710	114-912	0-1140	342-1254	0-1140	114-798	114-684	114-798	0-798	0-798
	Average	558	495	665	459	477	501	302	326	335	334	252	142
University	Range	228-3078	342-2508	228-2850	342-2052	228-2052	570-1596	342-1254	228-1596	342-2394	0-1824	0-2166	0-2052
	Average	1036	940	971	641	771	802	620	533	691	618	456	514

[a] Station shut down 7/14 for re-roofing

Table 4-15 **Monthly Summary of 8-Hour Carbon Monoxide (µg/m^3)**

The month with the highest annual value is highlighted

The state 8-hr CO standard is 5,000 µg/m^3, the federal 8-hr CO standard is 10,000 µg/m^3

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Honolulu[a]	Range	584-1468	0-1397	185-1610	14-627	185-1154	228-1102	456-755					
	Average	1007	556	712	333	681	463	572					
Kapolei	Range	399-912	342-755	485-1055	214-713	314-879	385-770	0-713	200-527	114-485	114-556	95-505	0-361
	Average	559	495	665	460	477	499	297	327	335	333	254	142
University	Range	371-1895	485-1724	356-1710	342-1511	371-1384	570-1183	356-969	257-1026	356-1853	100-1126	0-1292	86-1226
	Average	1040	938	869	639	771	804	617	532	691	618	457	515

[a] Station shut down 7/14 for re-roofing

Table 4-16 **Monthly Summary of 3-Hour Sulfur Dioxide (µg/m^3)**

The month with the highest annual value is highlighted **The state and federal 3-hr SO_2 standards are 1300 µg/m^3**

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Honolulu[a]	Range	0 - 75	0 - 10	0 - 23	0 - 41	0 - 14	0 - 1	0 - 1					
	Average	4	1	1	1	0.4	0.1	0.1					
Kapolei	Range	0 - 64	0 - 17	0 - 19	0 - 28	0 - 8	0 - 12	0 - 10	0 - 14	0 - 18	0 - 5	0 - 4	3 - 7
	Average	2	1	1	1	3	4	4	2	2	2	3	3
Makaiwa	Range	0 - 27	0 - 47	0 - 70	0 - 45	3 - 35	3 - 11	3 - 12	0 - 40	0 - 16	0 - 23	3 - 40	3 - 59
	Average	4	3	6	4	5	4	3	4	3	3	4	5
West Beach	Range	0 - 13	0 - 10	1 - 40	2 - 9	0 - 11	0 - 3	0 - 3	0 - 5	0 - 7	0 - 4	0 - 16	0 - 10
	Average	1	2	3	3	2	1	0	0	0	1	2	3
Hilo	Range	3 - 478	3 - 332	3 - 733	0 - 189	0 - 317	0 - 10	2 - 10	3 - 23	2 - 108	0 - 74	0 - 337	0 - 515
	Average	35	13	27	5	5	2	3	3	4	4	12	14
Kona[b]	Range	4 - 77	5 - 82	3 - 83	5 - 44	5 - 58	3 - 47	0 - 53			4 - 39	5 - 43	5 - 80
	Average	9	17	16	14	14	12	10			13	9	14
Puna E[c]	Range		0 - 3	0 - 34	0 - 502	0 - 3	3 - 5	2 - 3	3 - 3	3 - 3	3 - 3	3 - 4	3 - 128
	Average		0	2	3	2	3	3	3	3	3	3	6

[a] Station shut down 7/14 for re-roofing [b] Station shut down 7/27, moved, and began operating again 9/13 [c] Station began SO_2 monitoring on 2/17/05

Table 4-17 **Monthly Summary of 24-Hour Sulfur Dioxide (µg/m^3)**

The month with the highest annual value is highlighted **The state and federal 24-hr SO_2 standards are 365 µg/m^3**

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Honolulu[a]	Range	0 - 23	0 - 3	0 - 6	1 - 13	0 - 4	0 - 0	0 - 0					
	Average	4	1	1	1	0.4	0	0					
Kapolei	Range	0 - 21	0 - 3	0 - 4	0 - 5	0 - 6	0 - 9	1 - 5	0 - 4	0 - 5	0 - 3	2 - 3	3 - 4
	Average	2	1	1	1	2	3	4	2	2	2	3	3
Makaiwa	Range	0 - 10	0 - 10	0 - 19	2 - 13	3 - 12	3 - 6	3 - 5	1 - 9	2 - 6	0 - 5	3 - 8	3 - 14
	Average	4	3	5	4	5	4	3	4	3	3	4	5
West Beach	Range	0 - 5	1 - 4	2 - 11	3 - 4	0 - 4	1 - 2	0 - 1	0 - 1	0 - 2	0 - 2	0 - 4	0 - 5
	Average	1	2	3	3	2	1	0	0	0	1	1	3
Hilo	Range	4 - 117	3 - 93	5 - 253	0 - 46	2 - 58	1 - 4	3 - 5	3 - 6	3 - 23	0 - 34	0 - 83	0 - 128
	Average	36	14	27	5	5	2	3	3	4	4	12	14
Kona[b]	Range	5 - 32	5 - 34	5 - 47	5 - 27	9 - 19	8 - 24	4 - 25			6 - 20	5 - 15	5 - 31
	Average	9	17	16	14	14	12	10			13	9	14
Puna E[c]	Range		0 - 0	0 - 14	0 - 96	0 - 3	3 - 3	2 - 3	3 - 3	3 - 3	3 - 3	3 - 3	3 - 30
	Average		0	2	3	2	3	3	3	3	3	3	5

[a] Station shut down 7/14 for re-roofing [b] Station shut down 7/27, moved, and began operating again 9/13 [c] Station began SO_2 monitoring on 2/17/05

Table 4-18 **Monthly Summary of 1-Hour Ozone (µg/m^3)**

The month with the highest annual value is highlighted **The federal 1-hr O_3 standard is 235 µg/m^3**

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Sand Island	Range	0 - 84	0 - 86	0 - 116	2 - 108	2 - 74	6 - 63	2 - 65	0 - 55	0 - 63	0 - 71	0 - 65	0 - 86
	Average	37	44	50	50	30	29	25	25	24	31	24	36

Table 4-19 **Monthly Summary of 8-Hour Ozone (µg/m^3)**

The month with the highest annual value is highlighted **The state and federal 8-hr O_3 standards are 157 µg/m^3**

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Sand Island	Range	1 - 75	3 - 83	1 - 92	13 - 85	5 - 67	11 - 59	5 - 56	3 - 50	1 - 58	7 - 68	0 - 58	2 - 73
	Average	36	44	50	50	30	30	25	25	24	31	24	36

Table 4-20 **Monthly Summary of 1-Hour Hydrogen Sulfide (µg/m^3)**

The month with the highest annual value is highlighted

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Lava Tree	Range	0 - 13	0 - 13	0 - 6	0 - 7	0 - 13	1 - 7	0 - 8	0 - 8	0 - 10	0 - 3	0 - 3	0 - 3
	Average	4	3	1	1	2	2	1	1	1	0.2	0.2	0.4
Puna E	Range	0 - 3	0 - 3	0 - 4	0 - 3	0 - 3	0 - 1	0 - 1	0 - 44	0 - 1	0 - 1	0 - 1	0 - 3
	Average	0.1	0.1	0.5	0.4	0.6	0.4	0.1	0.2	0	0.1	0.1	0.4
Puna H	Range	0 - 3	0 - 3	0 - 3	0 - 3	0 - 3	0 - 3	0 - 3	0 - 3	0 - 3	0 - 4	0 - 1	0 - 1
	Average	0.2	0.2	0.3	0.2	0.5	0.7	0.8	0.8	0.9	0.9	0.1	0

The state H_2S standard is 35 µg/m^3, there is no federal ambient air standard for H_2S

Section 5
$PM_{2.5}$ SPECIATION DATA

Atmospheric aerosols are solid or liquid particles suspended in air that come directly from a variety of sources (primary) or are formed by chemical reactions (secondary). Sources include dust from roads, construction, and agriculture; combustion particles from motor vehicles, electric utilities and agricultural burning; and particles from natural sources such as the ocean or volcano.

Most of the $PM_{2.5}$ is a combination of the following components: sulfates, nitrates, ammonium, elemental carbon, organic compounds, water and metals.

The filter-based speciation sampler at the Pearl City monitoring station collects samples once every 6 days for analyses performed by an EPA contract laboratory.

Table 5-1 lists the parameters measured, highest and second highest values recorded in the year, the annual arithmetic mean of all valid samples and the total number of samples collected in the year. Table 5-2 lists the analysis methods for each parameter.

With the exception of lead, there are no ambient air quality standards for the individual components of speciated $PM_{2.5}$.

Table 5-1 **Annual Summary of $PM_{2.5}$ Speciation Parameters**

Parameter	1st High µg/m3	2nd High µg/m3	Annual Arithmetic Mean	No. of Samples
CARBON				
Organic Carbon	2.7	2.56	1.581	55
Elemental Carbon	0.58	0.55	0.216	55
METALS				
Antimony	0.043	0.043	0.0160	55
Arsenic	0.002	0.002	0.0009	55
Aluminum	0.063	0.056	0.0143	55
Barium	0.130	0.110	0.0200	55
Bromine	0.004	0.003	0.0013	55
Cadmium	0.020	0.010	0.0068	55
Calcium	0.084	0.083	0.0272	55
Chromium	0.034	0.031	0.0030	55
Cobalt	0.001	0.001	0.0008	55
Copper	0.024	0.012	0.0046	55
Chlorine	1.840	1.360	0.4848	55
Cerium	0.065	0.065	0.0182	55
Cesium	0.028	0.028	0.0094	55
Europium	0.009	0.009	0.0033	55
Gallium	0.004	0.004	0.0015	55
Iron	0.155	0.116	0.0349	55
Hafnium	0.020	0.020	0.0103	55
Lead	0.009	0.005	0.0023	55
Indium	0.025	0.023	0.0083	55
Manganese	0.002	0.002	0.0011	55
Iridium	0.009	0.009	0.0029	55
Molybdenum	0.004	0.004	0.0034	55
Nickel	0.011	0.009	0.0020	55
Magnesium	0.133	0.105	0.0227	55
Mercury	0.007	0.005	0.0023	55
Gold	0.007	0.007	0.0024	55
Lanthanum	0.050	0.050	0.0137	55
Niobium	0.004	0.003	0.0020	55
Phosphorus	0.008	0.008	0.0058	55
Selenium	0.002	0.002	0.0012	55
Tin	0.020	0.014	0.0101	55
Titanium	0.013	0.011	0.0030	55
Samarium	0.006	0.005	0.0028	55
Scandium	0.007	0.007	0.0053	55
Vanadium	0.006	0.006	0.0018	55
Silicon	0.252	0.171	0.0363	55

Table 5-1 Continued

Parameter	1st High µg/m3	2nd High µg/m3	Annual Arithmetic Mean	No. of Samples
Silver	0.018	0.017	0.0062	55
Zinc	0.007	0.007	0.0016	55
Strontium	0.008	0.004	0.0016	55
Sulfur	1.930	1.190	0.2478	55
Tantalum	0.015	0.015	0.0056	55
Terbium	0.013	0.006	0.0031	55
Rubidium	0.002	0.002	0.0010	55
Potassium	0.258	0.088	0.0348	55
Yttrium	0.003	0.002	0.0014	55
Sodium	0.940	0.752	0.3011	55
Zirconium	0.006	0.005	0.0020	55
Tungsten	0.011	0.011	0.0044	55
IONS				
Ammonium Ion	1.73	1.18	0.155	55
Sodium Ion	1.62	1.06	0.487	55
Potassium Ion	0.24	0.09	0.020	55
Total Nitrate	0.79	0.48	0.206	55
Sulfate	5.57	4.10	0.979	55

Table 5-2 **Speciation Collection and Analysis Methods**

Parameter	Collection Method	Analysis Method
Carbon	SASS[1] Quartz Filter	Thermal Optical Transmittance
Metals	SASS Teflon Filter	Energy Dispersive XRF
Ions	SASS Nylon Filter	Ion Chromatography

[1] Trademarked equipment: Speciation Air Sampling System

Section 6
AMBIENT AIR QUALITY TRENDS

The following graphs illustrate 5-year trends for PM_{10}, $PM_{2.5}$, ozone, carbon monoxide, sulfur dioxide, and nitrogen dioxide from 2001 to 2005.

The graphs for PM_{10}, $PM_{2.5}$, sulfur dioxide and nitrogen dioxide (figures 6-1, 6-2, 6-3 and 6-4, respectively) represent the annual averages for each year and for each station that monitors for that pollutant. Annual averages are derived by calculating the arithmetic mean of all valid hours recorded in the year. Included in the graphs are the state and federal annual standard(s).

The graphs for 1-hour ozone, 1-hour carbon monoxide, and 8-hour carbon monoxide (figures 6-5, 6-6 and 6-7, respectively) represent the average of the daily maximum 1-hour or 8-hour values recorded in the year. These values are obtained by taking the highest recorded 1-hour or 8-hour value for each day then calculating the arithmetic mean of all those hours to arrive at the annual maximum average. Ozone and carbon monoxide do not have state or federal annual standards, however, included in the graphs are the 1-hour and 8-hour standards.

Air quality in the State of Hawaii continues to be one of the best in the nation, and criteria pollutant levels remain well below state and federal ambient air quality standards.

Figure 6-1 **PM_{10} Annual Average 2001 - 2005**

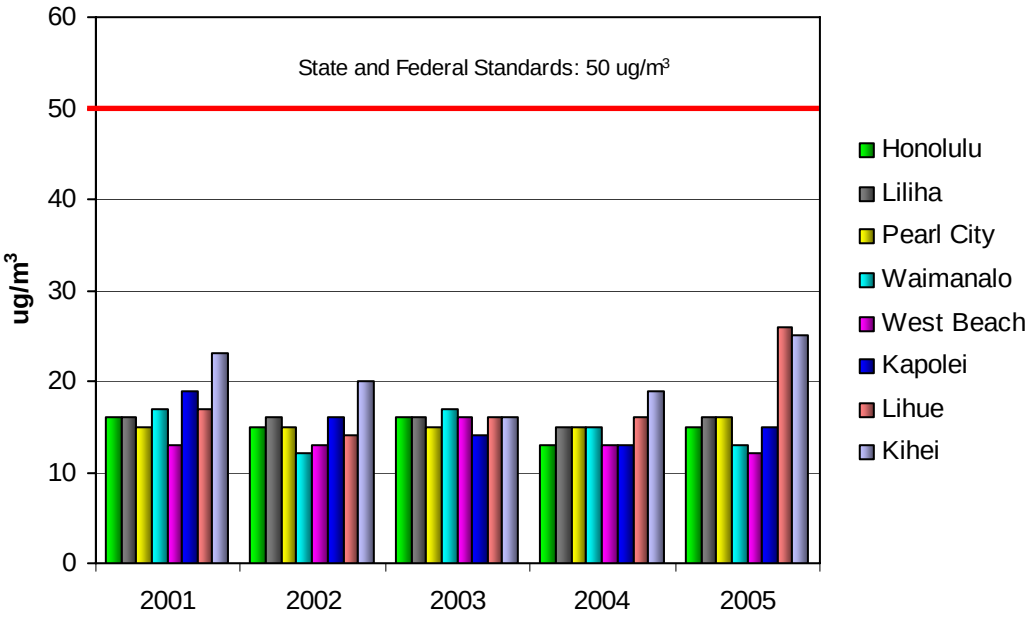


Figure 6-2 **$PM_{2.5}$ Annual Average 2001 - 2005**

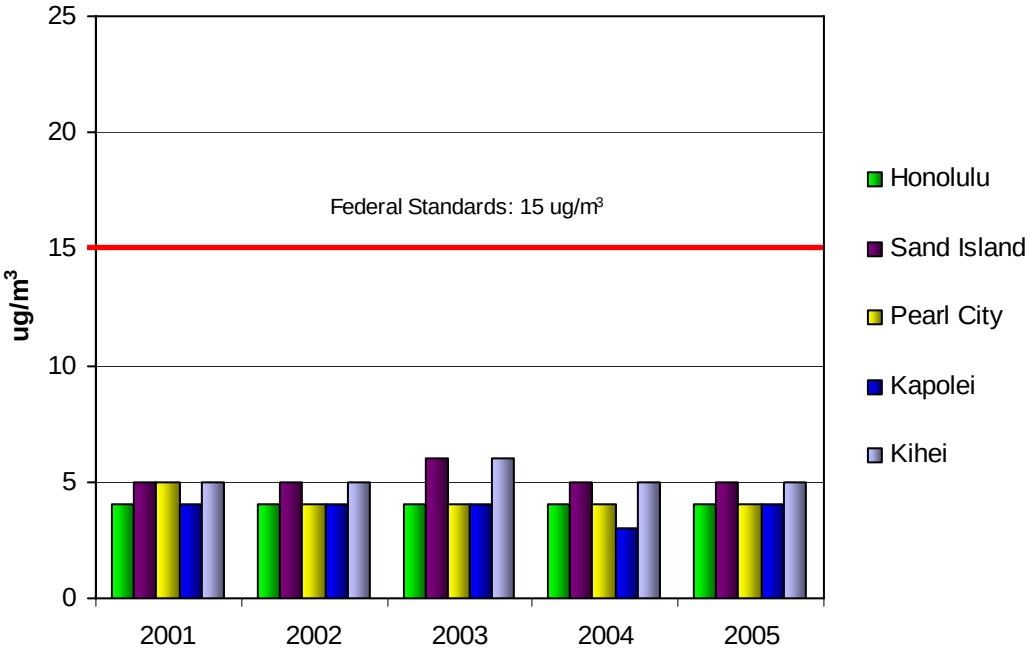


Figure 6-3 **Annual Average Sulfur Dioxide 2001 - 2005**

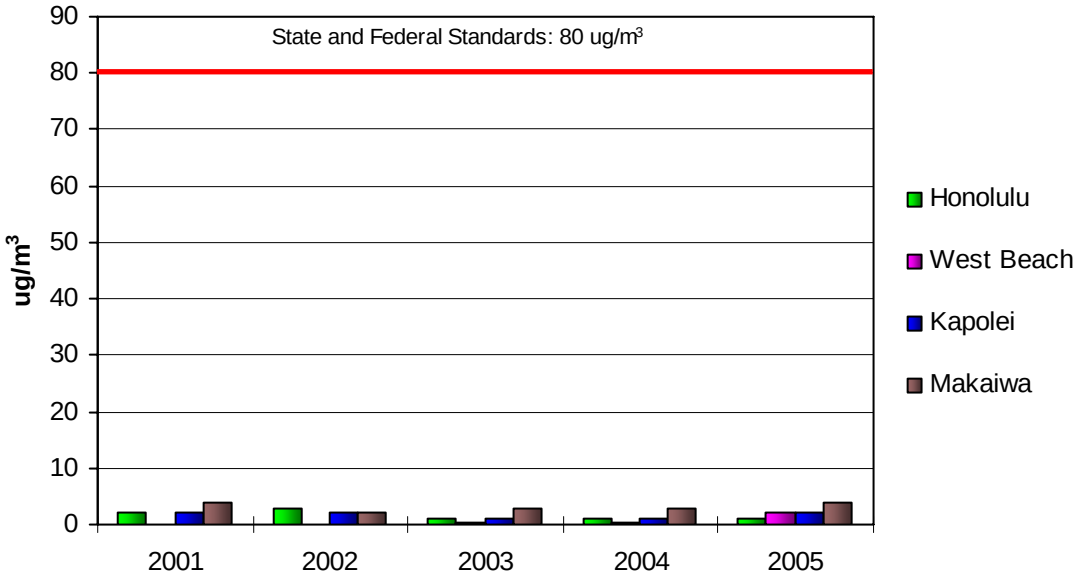


Figure 6-4 **Annual Average Nitrogen Dioxide 2001 - 2005**

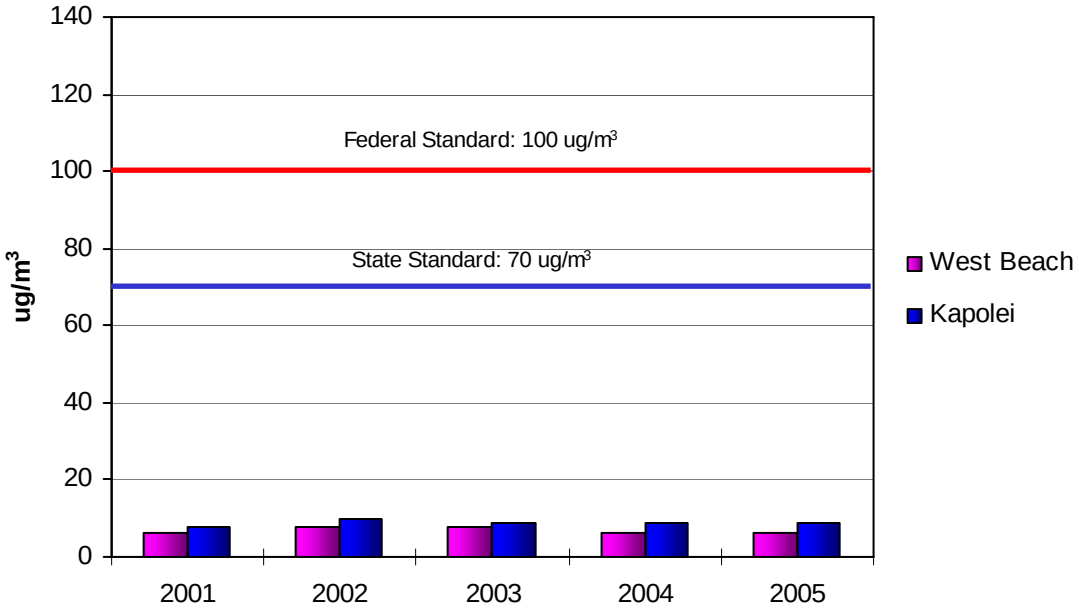


Figure 6-5 **Annual Average of Daily Maximum 1-Hour Ozone 2001 - 2005**

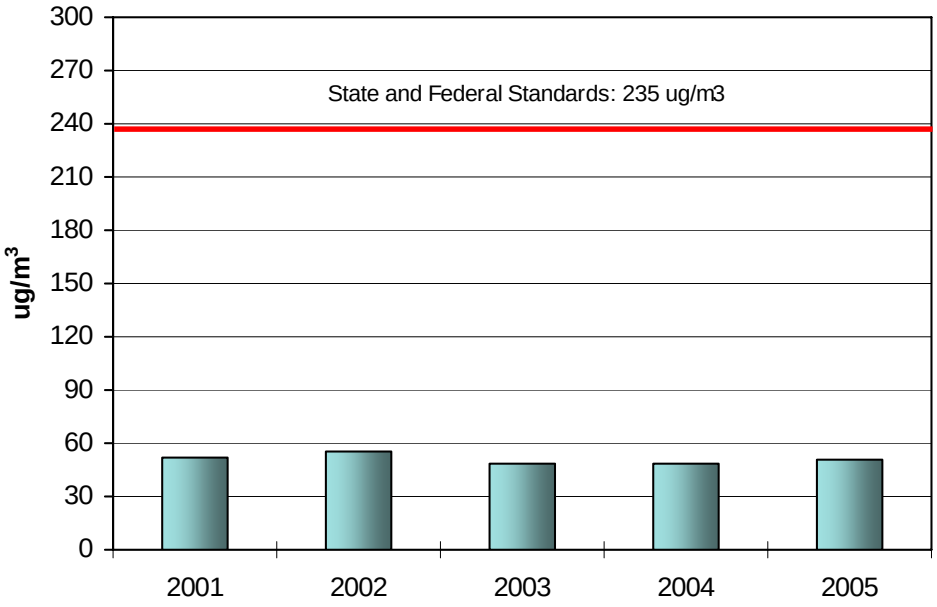
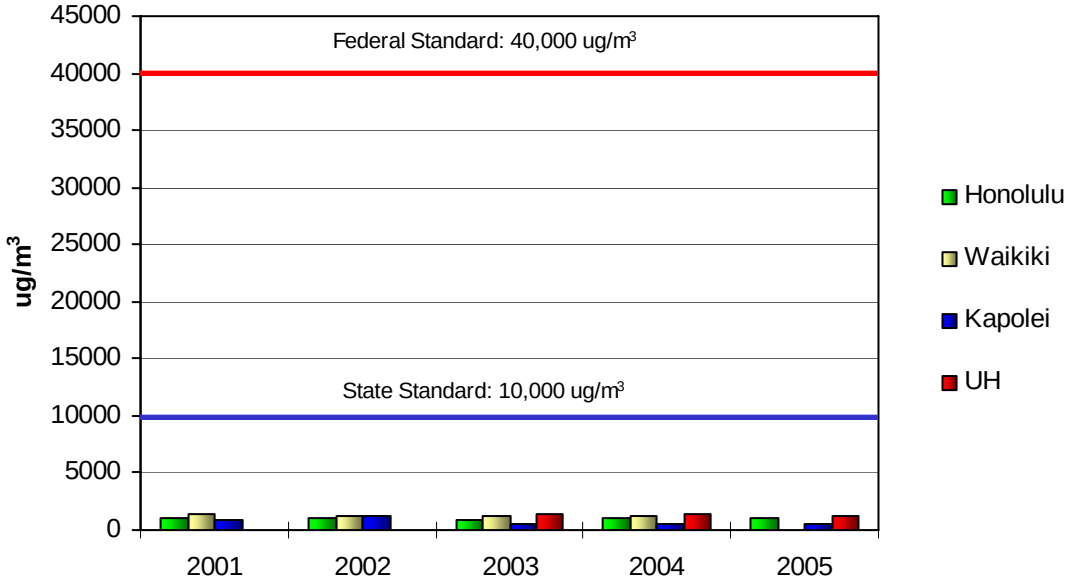
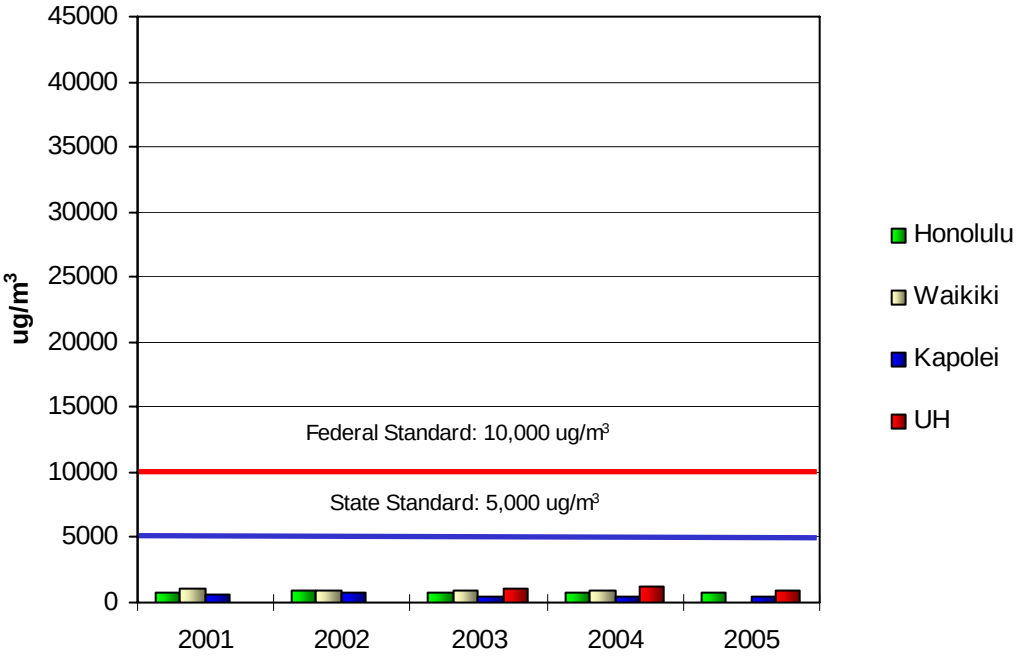


Figure 6-6 **Annual Average of Daily Maximum 1-Hour Carbon Monoxide 2001 - 2005**



Waikiki station closed 11/04; UH station began operation 11/02

Figure 6-7 **Annual Average of Daily Maximum 8-Hour Carbon Monoxide 2001 - 2005**



Waikiki station closed 11/04; UH station began operation 11/02